

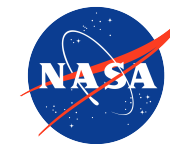


Latest-Launch-Date Options for Missions to Uranus and Neptune

From 2017 Ice Giants Study (JPL D-100520)

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Orbiter-Class Mission: Launch-no-later-than Dates

JGA is available for Launches around 2030; next Launch opportunity w/ JGAs is around 2046.

JGAs confer a significant advantage in Delivered Mass and Flight Time.

Launching after the indicated dates results in insufficient mass delivered for an orbiter-class mission.

		Uranus	Neptune	Dual
Best Launch Years (JGA)		2030-2034	2029-2030	2031
DeltaIV-H	Chemical	2035	2029	n/a
	SEP	Any	2030	n/a
SLS-Block1B	Chemical	Any	2031	n/a
	SEP	Any	Any	2031
DeltaIV-H	SEP		Any	n/a
Legend		TOF < 12 yrs	TOF < 13 yrs	
(TOF is interplanetary portion only)			TOF < 20-25 yrs	

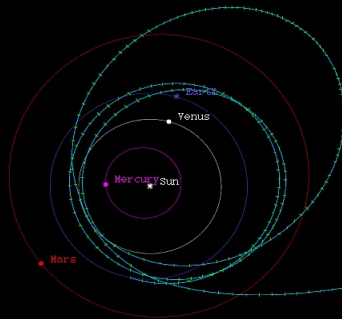
Uranus Summary

Baseline IP Trajectory (SEP, using Team-X heavy SEP stage)

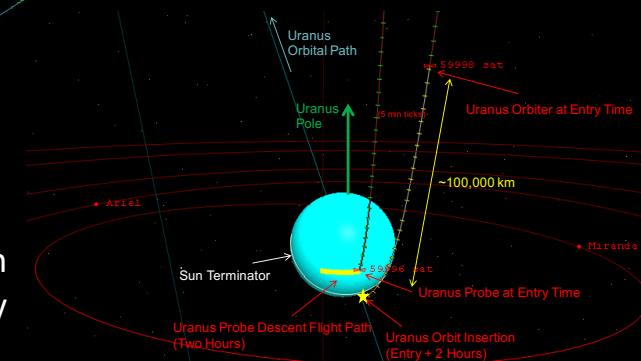
Flyby Sequence	Launch vehicle	Launch Date	IP TOF (years)	Xenon mass (kg)	UOI ΔV (km/s)	Mass into orbit (kg)
Earth-VVE-Uranus	Delta-IV Heavy	9/26/2030	11	603	2.2	1988

Baseline IP Trajectory (Chemical)

Flyby Sequence	Launch vehicle	Launch Date	IP TOF (years)	UOI ΔV (km/s)	Mass into orbit (kg)
Earth-VEEJ-Uranus	Atlas-V 541	05/25/2031	12	1.7	1913

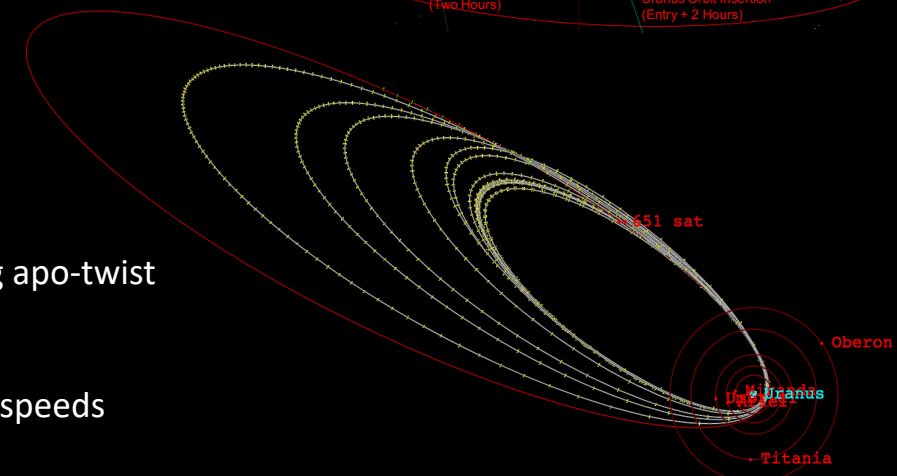


Uranus Orbit Insertion and Probe Entry



Baseline Tour

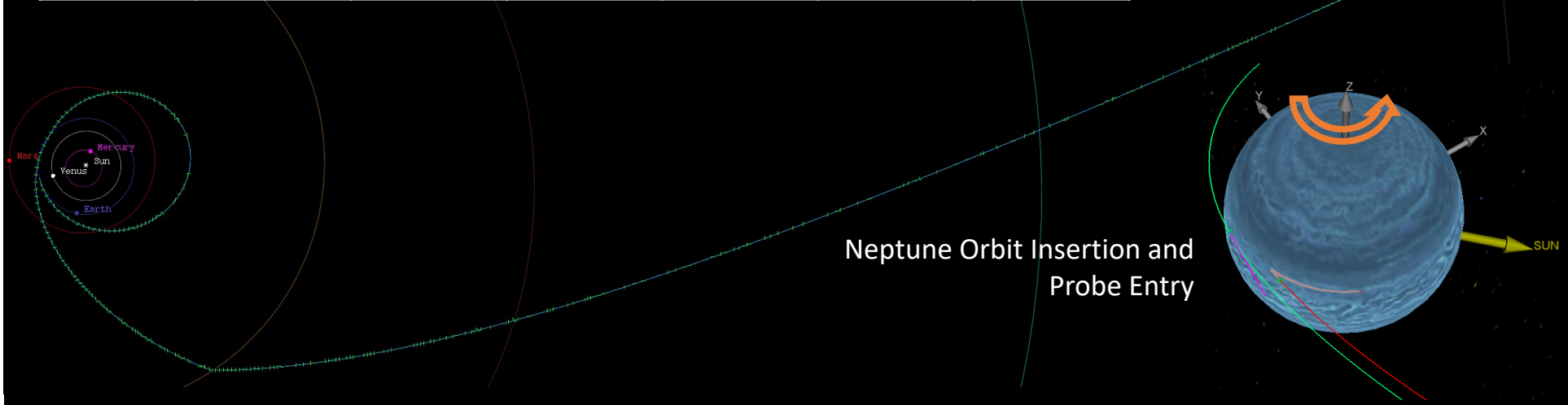
- New tour design with efficient plane change after UOI using apo-twist and targeting maneuver
- Total tour DV < ½ of previous Decadal Uranus mission
- At least two flybys of each of the five moons with low flyby speeds
- Tour duration < 2.5 years



Neptune Summary

Baseline IP Trajectory (SEP, using Team-X heavy SEP stage)

Flyby Sequence	Launch vehicle	Launch Date	IP TOF (years)	Xenon mass (kg)	NOI ΔV (km/s)	Mass into orbit (kg)
Earth-EJ-Neptune	Delta-IV Heavy	05/04/2030	13	436.2	2.7	2012.2



Baseline Tour

- Retrograde Neptune Orbit Insertion
- New tour design strategy with < 250 m/s total tour ΔV
- More than 25 Triton flybys with low flyby speeds (3 km/s)
- Tour duration < 2 years

Triton Flyby map

